1. Introduction

1.1 Background

The Common Operating Environment (COE)[1] provides a framework for developing and fielding Department of Defense (DoD) systems that meet the needs of the warfighter in a global information environment. As indicated in the Command, Control, Communications, Computers, and Intelligence (C4I) for the Warrior concept, "the warrior needs a fused, real-time true-picture of the battlespace and the ability to order, respond, and coordinate vertically and horizontally to the degree necessary to prosecute the mission in that battlespace." DoD relies on the COE to provide the degree of system integration and interoperability required to achieve this vision.

The COE addresses systems in the C4I and combat support domains within DoD. The C4I domain includes systems that facilitate the command and control of forces by the tactical commander, while the combat support domain includes systems that support logistics, transportation, base support, personnel, and health affairs functions. The Global Command and Control System (GCCS) and the Global Combat Support System (GCSS) are examples of C4I and combat support systems, respectively, that are based on the COE and support the joint warfighter.

The COE provides a client-server architecture for developing reusable, interoperable software from which systems tailored to the specific needs of a user community can be built. A COE-based system is composed of software components, called segments, contributed by different sources and maintained in a segment repository. Some segments are part of the COE because they perform common functions required by most systems, while other segments perform mission-specific functions that are targeted to particular operational communities. Software is included in the segment repository only if it conforms to strict standards and specifications that are required to support "plug and play" integration across a range of hardware platforms.

It is critical to the overall usability of a system that the software in the segment repository provide a user interface with a common appearance and behavior so users can interact effectively with any system built from this software. User interface standardization is particularly important as users are provided the capability to interact with a variety of complex, multi-windowed applications within a single system. The benefits to be gained from standardization are increased user productivity, reduced training requirements, improved system reliability, reduced maintenance costs, and increased efficiency in the development of individual applications as well as entire systems.

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[1] The concept of the Defense Information Infrastructure (DII) has been superceded by that of the Global Information Grid, and what was previously known as the DII COE is now referred to as the Common Operating Environment. As a result, references to the term "DII" have been removed from both the title and content of this release of the document.

1.2 Purpose

This document defines the user interface style to be delivered by software developed for the COE. The specifications provided here emphasize commonality in "look and feel" because it is a key element of usability as well as a requirement of the runtime environment defined by the COE. Compliance with COE style specifications is mandated for all software in the segment repository because the specifications define the "rules" for a well-behaved application[2] to operate predictably in a standard runtime environment. Compliance is especially important since the applications in a system can be built from multiple segments, each produced by a different organization.

A common "look and feel" is one that provides consistency in the appearance and behavior of user interface objects while allowing flexibility for addressing operational requirements. Implementing a common "look and feel" enables users to identify, remember, and predict the rules and organization of a system. By building consistency in the user interface, users can develop an effective and efficient model of how the system works and can generalize this knowledge to other systems. According to Mayhew in Principles and Guidelines in Software User Interface Design, a consistent user interface is one that provides:

- Consistent location of certain types of information on screens,
- Consistent syntax of commands in a command language,
- Similar execution of analogous operations in different applications,
- Consistent design of command names and abbreviations,
- Consistent grammatical form of error messages and instructions,
- Consistent design of captions and fields on forms and displays,
- Consistent dialog style for different functions, and
- Terminology consistent with the users' existing vocabulary.

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[2] In this document, the term "application" is used to refer to a user application, i.e., the software with which users interact to perform one or more related operational tasks. In the COE, the tasks in an application can be performed by software taken from different sources. As a result, an application may contain one or more segments, and a single segment may be present in one or more applications.

1.3   Scope

DoD policy concerning user interface standardization is published in the human-computer interface standards section of the DoD Joint Technical Architecture (JTA). This document indicates that user interface development is to be based on the style of a commercial graphical user interface (GUI), with additional guidance on design elements specific to DoD applications provided in domain- and system-level style guides. DoD policy on interoperability and supportability of information technology and national security systems is published in DoD Directive 4630.5. Paragraph 5.6.4 of this directive indicates that the Heads of DoD Components shall "implement procedures to ensure the use of DoD JTA, Common Operating Environment (COE) technical guidance, and COE technology for programs under the DoD Components' cognizance."

COE style specifications serve as the domain-level style guide for the C4I and combat support domains, in accordance with JTA policy on user interface standardization, and provide the COE technical guidance, per DoD Directive 4630.5, on user interface design of compliant software. In addition, COE style specifications are consistent with section 5.15 on user-computer interface in Military Standard (MIL-STD) 1472F and reference other military standards and specifications providing direction with relevance to user interface design in COE-based systems. Finally, the specifications address federal standards for information accessibility by individuals with disabilities and indicate the applicability of these standards to COE-compliant software.

This document provides style specifications for applications that have a GUI or a browser-based user interface. The specifications for GUI-based design conform to the style defined in version 1.2 or later of Motif, version 1.0 or later of the Common Desktop Environment (CDE), and the Microsoft (MS) guidelines for Windows NT and 2000 workstations. In addition, the specifications incorporate best commercial practices as published in the technical literature on user interface design. COE specifications comply with those Motif and CDE "required" and "recommended" style attributes considered essential to providing consistency in user interface implementation across COE-compliant applications, and with MS user interface requirements for the certification of desktop and server applications. An integrated set of specifications is provided whenever possible, with separate direction indicated where the two GUI style standards differ. The specifications deviate from Motif and MS Windows standards only when needed to accommodate COE runtime requirements or operational considerations, provided that the deviations are consistent with established user interface practice.

COE specifications for browser-based design are based on features available in version 3.2 of the Hypertext Markup Language (HTML) and incorporate guidance on Web page design published in the commercial literature and available on the Internet. COE specifications focus on the usability of Web applications and emphasize design consistency so that the warfighter is provided with rapid, effective access to information.[3]

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[3] This focus on "style" as it relates to the usability differs from that in most HTML style guides which discuss how to construct markup tags so they are readable and usable across browsers.

This document provides style specifications where the primary mode of user interaction is through a GUI or a Web browser. The specifications do not address the design of software providing a character-based interface or offer direction regarding possible migration of this type of interface to a GUI-based one. The specifications focus on the style attributes that compliant software must possess in order to be accepted into the segment repository and do not define or mandate a methodology or set of tools for user interface development. This document provides user interface specifications related to user-computer interaction, window and application design, and information presentation; this document does not provide environmental or ergonomic specifications addressing topics such as lighting and noise or workstation design and layout.

1.4 Style Requirements

1.4.1 Assumptions Concerning COE-Based Systems

It is assumed that a COE-based system will contain a mix of local applications installed on the user's platform and Web-based applications that are accessed via the Internet or local intranet. User interface services will be provided by X Window, Motif, and CDE on UNIX platforms and by MS Windows on Windows NT and 2000 platforms. A system is expected to use the version of CDE/Motif or MS Windows available in the COE and provide Web services, including support for Java, using the browser and other Web components in the COE.

A system will define the functionality (i.e., specific applications) available to different categories of users (e.g., operational personnel, system administrators) and will control access to these applications during system login. The workstation configuration will include a color monitor, a keyboard, and a pointing device (such as a mouse or trackball) with two or three buttons. The default environment is assumed to be an office-like workspace with normal ambient lighting, with systems installed in other operational workspaces expected to provide an implementation that meets the requirements of these environments.

1.4.2 COE Requirements for Style Implementation

A COE-compliant[4] application is expected to deliver a user interface that supports effective performance of mission-related tasks. An application can use a GUI such as Motif or MS Windows to present a windowing environment and interface components with which users can interact, or it can provide a browser-based interface that relies on the features of HTML to provide access to Web-based information. The user interface can be developed using a GUI toolkit or builder product if an application is targeted for a single platform, or the user interface can be built using Java class libraries if an application is to be available on multiple platforms. Because visual and functional consistency within and among applications is a key element of system usability, the COE defines the following style requirements for the user interface in all compliant software:

- An application with a Motif GUI shall have a COE-compliant Motif style.
- An application with an MS Windows GUI shall have a COE-compliant MS Windows style.
- A Java-based application shall have a COE-compliant style that matches the GUI of the host platform.
- An application with a browser-based interface shall have a COE-compliant browser style.

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[4] The term "COE compliant" is used throughout this document when referring to the compliance of software in the COE as well as mission-specific software that is outside the COE.

An application available on the user's platform is expected to possess all of the style attributes of a GUI in accordance with Motif and MS Windows standards. These attributes include both the appearance and behavior (i.e., "look and feel") of individual interface components as well as the design rules for the labeling, ordering, and placement of these components. Motif and MS Windows provide a similar "look and feel" in the set of components each support but differ in some design rules which cause each GUI to have some unique style features. COE specifications define the style attributes of Motif and MS Windows interface components that may be present in an application. It is expected that an application will implement the set of components required to support effective performance of mission-related tasks and then ensure that these components have a COE-compliant style whenever they are present in the application.

Java provides the capability to create a standalone application that is portable to any platform where Java is supported, whether the application is Web-based or not. A Java-based application is expected to provide a user interface with the same appearance and behavior as that of a native application on the host platform. An application delivers the appropriate "look and feel" of individual interface components as well as complies with the visual design rules for each GUI. If an application cannot adapt its style to fit these rules (e.g., adjust the order and placement of components) for each GUI, it complies with the MS Windows design rules as defined in COE style specifications. Compliance with MS Windows rules is required, since users are expected to interact with Java-based applications on a Windows NT or 2000 client where the native style is MS Windows.

Web-based applications rely on a browser to render information whose appearance and content have been formatted in accordance with HTML standards. The user interface for these applications makes use of the style tags supported by HTML and is designed for effective information presentation and navigation as defined by the specifications provided here. If desired, Java can be used to extend the capabilities of the browser environment so that GUI components and interactive multimedia are available in Web-based applications. These applications are expected to deliver a COE-compliant style when viewed on different browsers and platforms and to ensure that application functionality is not compromised as a result of browser- or platform-specific features.

COE style specifications require consistency in the implementation of commonly used interface components regardless of the development environment selected to render the components. An application is expected to have the style attributes called for by COE specifications, whether the user interface was generated using the Motif or MS Windows toolkit, a GUI builder or virtual prototyping product, or a set of platform-independent class libraries. DoD organizations are responsible for selecting a development tool that produces a user interface with the required style attributes. Software that makes use of commercial off-the-shelf (COTS) tools or integrates COTS products shall be configured to comply with COE specifications insofar as possible. DoD organizations need to determine the extent to which a tool or product will generate a user interface with a noncompliant style and if these divergences will have a negative impact on system usability when the software is integrated with other COE-compliant applications.

1.4.3 COE Compliance with Federal Accessibility Standards

Section 508 of the Rehabilitation Act requires that individuals with disabilities have access to and use of information that is comparable to that provided to federal employees and members of the public who are not disabled. The standards created under Section 508 define technology accessibility requirements for all types of information technology in the federal sector. Appendix J provides an overview of Section 508 and lists the accessibility standards that apply to software applications and operating systems, web-based intranet and internet information and applications, telecommunications products, video and multi-media products, self-contained closed products such as information kiosks, and desktop and portable applications.

All federal agencies are required to comply with Section 508 standards, with a limited exemption for systems used for military command, weaponry, intelligence, and cryptologic activities. COE-compliant software intended for use only in C4I and combat support systems falls within the limited exemption allowed for defense-related systems. However, the exemption does not apply to routine business and administrative systems used for other defense-related purposes or by defense agencies or personnel. Consequently, COE-compliant software that will be used in these systems is required to comply with the accessibility standards listed in Appendix J.[5]

COE style specifications already comply with some of the accessibility standards created under Section 508 because these standards represent good design practice for all users, whether or not they are disabled, and will increase software usability for the warfighter in an operational environment. COE-compliant applications that are exempt from Section 508 standards are expected to comply with these style specifications. The remaining accessibility standards focus on providing redundancy in information presentation and interaction so individuals with disabilities can use different modalities to access information. COE specifications call for information redundancy where it will provide value-added for the warfighter but not at the level called for in the accessibility standards. COE-compliant applications that are exempt from Section 508 standards are expected to support information redundancy as defined in COE specifications. COE-compliant applications that are non-exempt must comply with the standards related to information redundancy listed in Appendix J of this document.

1.4.4 COE Compliance with Microsoft Certification Requirements

Microsoft publishes specifications that define the technical requirements for desktop and server applications to earn the "Certified for Microsoft Windows" logo. The following requirements apply to the user interface of both Windows NT and 2000 desktop applications unless otherwise indicated:

- Support standard system size, color, font, and input settings.

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[5] In the remainder of this document, an application is "non-exempt" if it is required to comply with Section 508 standards, and "exempt" if it is not subject to the standards.

- Ensure compatibility with the High Contrast option.
- Provide documented keyboard access to all features.
- Expose the location of the keyboard focus.
- Do not rely exclusively on sound.
- Do not place shortcuts to documents, help, or uninstall in the Start menu.
- Support multiple monitors. (required for Windows 2000 applications only)

The following requirements apply to the user interface of Windows 2000 server, advanced server, and data center server applications:

- Support standard system size, color, and input settings.
- Ensure compatibility with the High Contrast option.
- Provide documented keyboard access to all functions.
- Expose the location of the keyboard focus.
- Do not place shortcuts to documents, help, or uninstall in the Start menu.

The COE uses Microsoft specifications as the primary set of requirements that COE-compliant software on a Windows NT or 2000 platform must meet. As indicated in the DII COE Integration and Runtime Specification (I&RTS), COE-compliant software may diverge from these specifications in order to meet operational requirements that do not apply to commercial software. Because compatibility with the High Contrast option is not applicable to defense-related systems, COE-compliant applications that are exempt from Section 508 standards do not have to comply with this requirement. Compatibility with the High Contrast option is required for COE-compliant applications that are non-exempt. Compliance with the requirements related to multiple monitor support and Start menu configuration will be addressed in a future version of the COE style specifications. The COE requires compliance with all remaining user interface requirements in the Microsoft specifications for desktop and server applications.

1.5   Compliance

1.5.1   Segment-Level Compliance

The Defense Information Systems Agency (DISA) specifies the style requirements to be satisfied at each compliance level defined by the COE and makes tools available for assessing style compliance. Compliance with COE style specifications is required in the development of all new software and the migration of existing software submitted for inclusion in the segment repository. DoD organizations are expected to comply with all style specifications, with deviations occurring only when called for by operational requirements. New software shall be developed in accordance with COE requirements and be fully compliant with all style specifications; existing software is expected to migrate to full COE compliance. DoD organizations are expected to comply with the intent of the specifications which define the style requirements for compliant software and do not preclude all possible inappropriate, incorrect, or unacceptable implementations.

Appendix I maps COE style specifications to each of the style-related items in the compliance checklist published in the DII COE I&RTS. A segment must satisfy all of the requirements for a given style-related item in order to be considered to comply with the item. As indicated in the I&RTS, the compliance level assigned to a segment is the highest numbered level where all of the checklist items have been satisfied. While the COE calls for compliance with all of the items in the checklist, only a subset of the requirements related to runtime environment is considered essential to establishing the compliance level. As a result, while "style guide" is one of the compliance areas defined by the COE, software being evaluated for compliance can achieve a particular level without submitting verification to DISA that it has met the style-related requirements defined at that level.

Developers are expected to address COE style requirements as part of their software development process, even though they do not have to provide documentation to DISA that they have satisfied these requirements when being evaluated for compliance. Because assessing style compliance is acknowledged to be a labor-intensive manual process, DISA provides a software tool to assist in performing this task. The Style Compliance Test Protocol (SCTP)[6] supports automated administration of a checklist of style attributes derived from COE style specifications. SCTP improves the speed and efficiency of the manual assessment process by focusing on the style attributes of the specific interface component, window type, GUI or browser style, and compliance level being assessed. Use of the tool forces developers to attend to the details of their user interface design which, taken together, are critical to the overall usability of the software. Developers are encouraged to use SCTP early in the user interface design process and to incorporate style compliance assessment into their software quality assurance process.

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[6] Two versions of SCTP are available, both of which can be loaded on a Windows workstation. One version can be installed using the native tools provided by Windows, while the other requires the COE kernel to be installed and uses the COE Installer.

1.5.2 System-Level Compliance

COE-based systems are expected to provide a COE-compliant desktop configuration.[7] An icon-based desktop is the preferred implementation for systems available on UNIX platforms and is the one that satisfies style compliance requirements related to desktop configuration. This implementation makes use of the desktop management capabilities provided by CDE, with segment functions accessed from application icons available in the CDE Application Manager. A menu-based desktop is allowed for legacy systems and for systems with limited screen space and/or operational requirements that dictate its use. In this case, the desktop makes use of the management capabilities provided by CDE, with segment functions available from a system menu bar on the desktop. An icon-based desktop is the only implementation that satisfies COE compliance requirements related to desktop configuration for systems available on Windows NT and 2000 platforms. This implementation makes use of the desktop management capabilities provided by Microsoft for Windows workstations, including use of the Start Menu for accessing applications.

The extent to which a system is COE-compliant is determined by aggregating the compliance levels of its component segments. The DII COE I&RTS explains how to compute the overall compliance level of a COE-based system. Because style-related items are included in the compliance checklist in the I&RTS, the overall style compliance of a system is reflected in its level of compliance in the runtime environment category. Organizations desiring to deliver a COE-compliant system but with operational requirements that dictate an alternate style implementation shall obtain a waiver from DISA or cognizant Chief Engineer in order to diverge from COE specifications.

DoD organizations desiring to define system-specific user interface requirements not addressed here or previously waivered shall do so by documenting them in an addendum to this document. The addendum shall provide detailed guidance concerning user interface features not specifically addressed here as they relate to the needs of the user community for whom the system is intended. The addendum shall maintain consistency with the user interface style defined by the COE, extending the scope and content of the specifications as needed to address unique operational requirements. The addendum shall be written so that it supplements, rather than duplicates, information already included here. Republication of the COE style specifications, with changes to reflect system-unique requirements, is strongly discouraged.

1.5.3 Minimum Style Requirements for COE Compliance

While COE style specifications allow DoD organizations to tailor the user interface to address operational requirements, some elements of a user interface shall not be modified in COE-compliant software. The following elements are central to a GUI paradigm and are considered essential to the COE integration process at the user interface level:

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[7] Style compliance requirements related to desktop configuration will be published at a future date in a separate document.

- The hotspot of the pointer shall indicate the locus of user input with the pointing device.
- The location cursor shall indicate the locus of user input from the keyboard.
- Only one window shall have input focus at any time and can accept keyboard input.
- Window management operations shall be governed by parent-child relationships within the window family.

COE-compliant software must satisfy these minimum requirements in order to achieve level 1 style compliance. Requests for waivers to diverge from these requirements shall be directed to DISA or cognizant Chief Engineer and considered on a case-by-case basis.

1.5.4 Modifications to Style Specifications

COE style specifications shall be modified as needed to ensure continued compliance with Motif and MS Windows style direction, maintain consistency with DoD policy and publications on user interface design, and address new technologies, especially as they relate to the evolution of Web-based desktops and network-centric user interfaces. The specifications will be revised as needed to maintain currency with the COE and document the evolution of the COE user environment. Requests to modify the specifications shall be submitted for consideration in accordance with configuration management procedures established for the document by DISA. Requests to modify the implementation of a user interface feature in COE software shall be directed to the organization with configuration management responsibility for the software.

1.6   Document Overview

The remainder of this document describes the interface components and design rules for Motif and MS Windows applications, provides direction on page design and information presentation in browser-based applications, and explains how applications are created and integrated with the desktop in COE-based systems. The appendices offer additional information on topics such as keyboard input, action vocabulary and graphics, developer notes, and style compliance requirements. Unless otherwise indicated, the specifications apply to both Motif and MS Windows interfaces; if a specification applies to only one of the GUIs, it is identified as such.

- Sections 2 and 3 describe the input devices available to users and the manner in which they use these devices to interact with an application. Sections 4 through 7 address the appearance and behavior of individual interface components including windows, menus, and controls that may be present in an application.

- Section 8 covers visual design of primary and secondary windows, with sections 9 and 10 providing specific formats for common secondary windows and map windows. Section 11 focuses on the availability of user support resources, while section 12 addresses the presentation of text and graphic information.

- Sections 13 and 14 describe page design, the presentation of text, images, and multimedia, and interactive capabilities in browser-based applications.

- Section 15 describes approaches to application design and integration with the desktop, then section 16 describes object-oriented design and provides direction for applications implementing this design approach.

- Section 17 provides guidance related to user interface internationalization. This section is included for use by DoD organizations with a requirement to provide internationalized software and is not considered in determining COE style compliance.

- Appendix A identifies the functions assigned to keys in Motif and MS Windows, and appendix B maps these keys to the keyboards for several COE hardware platforms.

- Appendix C defines standard vocabulary, mnemonics, and shortcut keys for common actions; appendix D provides graphics for some of these actions.

- Appendix E contains developer notes describing color sets, fonts, and application icon design in Motif and MS Windows; this appendix also provides general recommendations for implementing MIL-STD 2525 symbology.

- Appendix F lists acronyms and abbreviations used in the document. Appendix G maps the terminology in this document to that in Motif and MS Windows documentation, while Appendix H provides a glossary of style terminology.

- Appendix I maps the style specifications to COE compliance levels defined in the DII COE I&RTS.

- Appendix J describes federal standards for information accessibility by individuals with disabilities.

1.7 Typographic Conventions

The following typographic conventions are used in this document:

- The first letter of each word in push button actions (e.g., Cancel, OK) and menu titles and options (e.g., File, Save As) is capitalized.

- The left, middle, and right buttons on the pointing device are referred to as BLeft, BMiddle, and BRight, respectively.

- The names of keys on the keyboard are presented in upper-case letters (e.g., RETURN). Simultaneous key combinations are indicated by presenting the key names separated by a plus; for example, CTRL+HOME means that users hold down the CTRL key and then press the HOME key.

- HTML tags are indicated by brackets (e.g., <title>).

- References to the Microsoft Windows™ user interface and style are identified as "MS Windows" in order to differentiate them from statements about generic windows.

1.8   Source Documents

COE style specifications are based on the user interface standards and guidelines listed below.

Government Documents

Architectural and Transportation Barriers Compliance Board. Electronic and Information Accessibility Standards. Published in the Federal Register on December 21, 2000. http://www.access-board.gov/sec508/508standards.htm

Avery, L.W. & Bowser, S.E. (eds.) Human Factors Design Guidelines for the Army Tactical Command and Control System (ATCCS) Soldier-Machine Interface, Version 2.0. Pacific Northwest Laboratory for the U.S. Army Tactical Command and Control System Experimentation Site, Fort Lewis, WA, 1992.

Bowen, C.D. Theater Battle Management (TBM) Human Computer Interface (HCI) Specification, Version 1.2. The MITRE Corporation, Bedford, MA, 1995.

Defense Information Systems Agency. Defense Information Infrastructure (DII) Common Operating Environment (COE) Integration and Runtime Specification (I&RTS), Version 4.1, 2000.

Department of Defense. Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS). DoD Directive 4630.5, 2002. http://www.deskbook.osd.mil/htmlfiles/DBY_dod.asp

Department of Defense. Military Standard 1472F. Department of Defense Design Criteria Standard: Human Engineering. U.S. Army Aviation and Missile Command, Huntsville, AL, 1999.

Department of Defense. Military Standard 2525B. Common Warfighting Symbology, 1999. http://www-symbology.itsi.disa.mil/symbol/mil-std.htm

Department of the Air Force, Standard Systems Center (SSC). Graphical User Interface (GUI) Standards, Volume 1, 1993.

Donohoo, D., Schwarting, I, & Fernandes, K. Human Performance Considerations in the Implementation of MIL-STD 2525 Symbology. Space and Naval Warfare Systems Center, San Diego, 1999.

Federal IT Accessibility Initiative. http://www.section508.gov/

Joint Technical Architecture Development Group. Department of Defense Joint Technical Architecture, Version 4.0, 2002.

Operations Directorate Graphical User Interface Standards. Version 1.0.
Prepared by the Joint DO/DT GUI Standards Working Group, 1994.

Smith, S.L. & Mosier, J.N. Guidelines for Designing User Interface Software
(ESD0TR086-278). USAF Electronic Systems Center, Hanscom AFB, MA,
1986.

Non-Government Documents

Anuff, E. Java Sourcebook: A Complete Guide to Creating Java Applets for the
Web. New York: John Wiley & Sons, 1996.

Apple Computer, Inc. Guide to Macintosh Software Localization. Reading, MA:
Addison-Wesley Publishing Co., 1992.

Apple Computer, Inc. Human Interface Guidelines: The Apple Desktop
Interface. Reading, MA: Addison-Wesley Publishing Co., 1987.

Apple Computer, Inc. Mac OS 8 Human Interface Guidelines. Developer Note,
1997.

Constantine, L.L. & Lockwood, L.A.D. Software for Use: A Practical Guide to
the Models and Methods of Usage-Centered Design. Reading, MA: Addison-
Wesley Publishing Company, 1999.

Ferguson, P.M. Motif Reference Manual for OSF/Motif Release 1.2. Sebastopol,
CA: O'Reilly & Associates, Inc., 1993.

Fowler, S.L. GUI Design Handbook. New York: McGraw-Hill, 1998.

Fowler, S.L. & Stanwick, V.R. The GUI Style Guide. Boston, MA: Academic
Press, Inc., 1995.

Galitz, W.O. User-Interface Screen Design. Boston, MA: QED Publishing
Group, 1993.

Gardiner, M.M. & Christie, B. (eds.) Applying Cognitive Psychology to User-
Interface Design. Chichester: John Wiley & Sons, 1987.

IEEE Recommended Practice for Graphical User Interface Drivability
(Unapproved Draft 2), March 1992.

Johnson, J. GUI Bloopers: Don'ts and Do's for Software Developers and Web
Designers. San Francisco: Morgan Kaufmann Publishers, 2000.

Kobara, S. Visual Design with OSF/Motif. Reading, MA: Addison-Wesley Publishing Co., 1991.

Madell, T., Parsons, C. & Abegg, J. Developing and Localizing International Software. Englewood Cliffs, NJ: Prentice Hall, 1994.

Mandel, T. The Elements of User Interface Design. New York: John Wiley & Sons, Inc., 1997.

Mansfield, R. & Brannon, C. Microsoft Windows NT4 Workstation Desktop Companion. Research Triangle Park, NC: Ventana Communications Group, Inc., 1997.

Marcus, A., Smilonich, N. & Thompson, L. The Cross-GUI Handbook for Multiplatform User Interface Design. Reading, MA: Addison-Wesley Publishing Co., 1995.

Mayhew, D.J. Principles and Guidelines in Software User Interface Design. Englewood Cliffs, NJ: PTR Prentice Hall, 1992.

Microsoft Corporation. Application Specification for Microsoft Windows 2000 for Desktop Applications: Design Guide for Building Business Applications. Version 1.0a, 2000.

Microsoft Corporation. Application Specification for Microsoft Windows 2000 Server, Advanced Server, DataCenter Server: Design Guide for Building Server Applications. Version 1.3, 2000.

Microsoft Corporation. Microsoft Windows User Experience: Official Guidelines for User Interface Developers and Designers. Redmond, WA: Microsoft Press, 1999.

Microsoft Corporation. The Windows Interface Guidelines for Software Design. Redmond, WA: Microsoft Press, 1995.

Morris, M.E.L. & Hinrichs, R.J. Web Page Design. Mountain View, CA: SunSoft Press, 1996.

Nielsen, J. Designing Web Usability. Indianapolis, IN: New Riders Publishing, 2000.

O'Donnell, S.M. Programming for the World: A Guide to Internationalization. Englewood Cliffs, NJ: Prentice Hall, 1994.

Olsen, Jr., D.R. Developing User Interfaces. San Francisco: Morgan Kaufmann Publishers, Inc., 1998.

Open Software Foundation. <u>OSF/Motif Style Guide. Release 1.2</u>. Englewood Cliffs, NJ: Prentice Hall, 1992.

Open Software Foundation. <u>OSF/Motif User's Guide. Release 1.2</u>. Englewood Cliffs, NJ: Prentice Hall, 1992.

Perry, P.J. <u>Creating Cool Web Applets with Java</u>. Foster City, CA: IDG Books Worldwide, Inc., 1996.

Root, R.W. & McFarland, A.D. Graphical User Interface Design Guidelines for Bellcore Software Products. Issue 1. Bellcore/Bell Communications Research, Piscataway, NJ, 1993.

Shafran, A. <u>Enhancing Netscape Web Pages</u>. Indianapolis, IN: Que Corporation, 1996.

Sun Microsystems, Inc. <u>Java Look and Feel Design Guidelines: Advanced Topics</u>. Palo Alto, CA: Sun Microsystems, Inc., 2001.

Sun Microsystems, Inc. <u>Java Look and Feel Design Guidelines. Second Edition</u>. Palo Alto, CA: Sun Microsystems, Inc., 2001.

The Open Group. <u>CDE/Motif 2.1 Style Guide</u>. Witney, Oxon, UK: Open Group Publications, 1997.

The Open Group. <u>CDE/Motif 2.1 Style Guide Certification Checklist</u>. Witney, Oxon, UK: Open Group Publications, 1997.

The Open Group. <u>CDE/Motif 2.1 Style Guide Reference</u>. Witney, Oxon, UK: Open Group Publications, 1997.

Uren, E., Howard, R. & Perinotti,T. <u>Software Internationalization and Localization: An Introduction</u>. New York: Van Nostrand Reinhold, 1993.

User Interface Design With OSF/Motif. Open Software Foundation Training Course, Version 1.2, 1992.

<u>Online Documents</u>

Barlow, L. The Spider's Apprentice: A Helpful Guide to Web Search Engines. Monash Information Services, 2000. http://www.monash.com/spidap4.html

Berners-Lee, T. Style Guide for Online Hypertext. Massachusetts Institute of Technology, 1995. http://www.w3.org/pub/WWW/Provider/Style/

Detweiler, M.C. & Omanson, R.C. Ameritech Web Page User Interface Standards and Design Guidelines. Ameritech Corporation, 1996. http://www.ameritech.com/corporate/testtown/library/standard/web_guidelines/index.html

Gillespie, J. Web Page Design for Designers. Pixel Productions UK, 2001. http://www.wpdfd.com/wpdhome.htm

Hewlett-Packard Technical Computing Center. Motif and Common Desktop Environment: Style Guide, 1997. http://docs.hp.com:80/hpux/onlinedocs/B1171-90148/B1171-90148.html

Hewlett-Packard Technical Computing Center. Motif and Common Desktop Environment: Style Guide Reference, 1997. http://docs.hp.com:80/hpux/onlinedocs/B1171-90147/B1171-90147.html

Karp, T. Art and the Zen of Web Sites. TLC Systems Corporation, 1999. http://www.tlc-systems.com/webtips.html

Lynch, P.J. & Horton, S. Yale C/AIM Web Style Manual. Yale Center for Advanced Instructional Media, 1997. http://info.med.yale.edu/caim/manual/contents.html

Microsoft Corporation. MS Windows 98 Keyboard Guide, 1998. http://www.microsoft.com/TechNet/wind98/manuals/w98kbd.asp

Nielsen, J. The Alertbox: Current Issues in Web Usability. Sun Microsystems, 2001. http://www.useit.com/alertbox/

Raggett, D. W3C HTML 3.2 Reference Specification. WWW Consortium, 1997. http://www.w3.org/TR/REC-html32.html

Richmond, A. A Basic HTML Style Guide. Goddard Space Flight Center, 1994. http://heasarc.gsfc.nasa.gov/Style.html

Steel, W. Hints for Web Authors. University of Mississippi, 2000. http://www.mcsr.olemiss.edu/~mudws/webhints.html

Sullivan, D. Search Engine Watch. Calafia Consulting, 2001. http://searchenginewatch.internet.com/webmasters/

Sun Microsystems, Inc. Common Desktop Environment: Style Guide and Certification Checklist, 2000. http://docs.sun.com/ab2/coll.72.4/

The National Center for Supercomputing Applications. A Beginner's Guide to HTML. University of Illinois at Urbana-Champaign, 2000. http://www.ncsa.uiuc.edu/General/Internet/WWW/HTMLPrimerAll.html

Tilton, J.E. Composing Good HTML. Carnegie-Mellon University, 1998. http://www.ology.org/tilt/cgh/

Standards relating to the design of workstations, associated furniture, and the facilities in which they are placed can be found in MIL-STD 1472F and the following document:

American National Standards Institute. National Standard for Human Factors Engineering of Visual Display Terminal Workstations. Santa Monica, CA: The Human Factors Society, Inc., 1988.

Guidelines related to information accessibility can be found in the following documents:

Bergman, E. & Johnson, E. Towards Accessible Human-Computer Interaction. http://www.sun.com/access/developers/updt.HCI.advance.html

Chisholm, W., Vanderheiden, G., & Jacobs, I. Web Content Accessibility Guidelines 1.0. W3C Recommendation 5-May-1999. http://www.w3.org/TR/WAI-WEBCONTENT/

IBM Accessibility Center Guidelines. http://www-3.ibm.com/able/guidelines.htm

IBM Guidelines for Writing Accessible Applications Using 100% Pure Java. Version 2.1, 2000. http://www-3.ibm.com/able/snsjavag.html

Microsoft Windows Guidelines for Accessible Software Design. http://www.microsoft.com/enable/dev/guidelines/software.htm